Novel Mechanism in Self-Renewal/Differentiation of Human Embryonic Stem Cells

Grant Award Details

Novel Mechanism in Self-Renewal/Differentiation of Human Embryonic Stem Cells

Grant Type: Basic Biology II

Grant Number: RB2-01562

Project Objective: understanding in hESC biology towards (1) the epigenetic control of OCT3/4 and its functional contribution to the stem cell pluripotency, (2) the role of cell cycle regulatory mechanism in stem cell self-renewal/differentiation decision, and (3) the potential utilization of molecular regulatory mechanism for future regenerative therapeutics.

Investigator:

Name:	Yong Kim
Institution:	University of California, Los Angeles
Type:	PI

Human Stem Cell Use: Embryonic Stem Cell

Award Value: $1,259,371

Status: Closed

Progress Reports

Reporting Period: Year 1

View Report

Reporting Period: Year 2

View Report

Reporting Period: Year 3

View Report

Reporting Period: NCE

View Report

Grant Application Details

Application Title: Novel Mechanism in Self-Renewal/Differentiation of Human Embryonic Stem Cells

Public Abstract:

The most prominent feature of the stem cell is its pluripotent capacity to differentiate into various types of cells. The importance of the orchestrated interplay between molecular regulators has been demonstrated in the maintenance of self-renewing pluripotent property or the initiation of differentiation. Advance in the generation of the induced pluripotent stem cells (iPSCs) have been benefitted by our knowledge on the molecular regulation in stem cell renewal/differentiation. Furthermore, the practical use of stem cells for regenerative medicine will be possible through our understanding on the mechanism underlying distinct differentiation process.

Recent progress in stem cell biology has unveiled some important features of molecular and cellular regulations in stem cell pluripotency and differentiation, but it remains largely elusive. The proposed study is based on our recent published findings that demonstrate the significance of the cell cycle regulatory molecule in embryonic stem cell self-renewal and differentiation. Our published data strongly supports that CDK2AP1 (CDK2 associating protein 1) is a competency factor in mouse embryonic stem cell (mESC) differentiation. Even though the difference in molecular regulation between mouse and human has been documented, it is also accepted that they share common molecular mechanism in the maintenance of self-renewal/differentiation. Especially the importance of the role of OCT3/4 in stem cell maintenance and pluripotency has been well documented in both models. This study is focused on the molecular and cellular mechanism and is an innovative research in a sense that the proposed study will unveil a novel mechanism in stem cell regulation.

Specific Aims proposed in this application will significantly advance our understanding in hESC biology towards (1) the epigenetic control of OCT3/4 and its functional contribution to the stem cell pluripotency, (2) the role of cell cycle regulatory mechanism in stem cell self-renewal/differentiation decision, and (3) the potential utilization of molecular regulatory mechanism for future regenerative therapeutics.

Statement of Benefit to California:

The medicine today is facing two equally pressing issues in the treatment of patients- providing a life-saving quality treatment in the mean time at an affordable cost to every patient. California has the highest healthcare costs of any state in the nation – more than $110 billion per year. In that sense, the regenerative medicine offers an initiative for the future of medicine. The regenerative medicine is the ultimate goal of the future medicine in treatment of patients suffering from both genetic and non-genetic disorder. The benefit of stem cell research is almost unlimited in developing breakthrough cures and treatment for debilitating diseases and injuries, including diabetes, cancer, heart disease, Alzheimer's, Multiple Sclerosis, HIV/AIDS, Parkinson's, ALS, osteoporosis and spinal cord injuries. Unfortunately, our current knowledge on stem cell biology is far behind what we need to know in order to make the stem cell therapy available to the patients in the clinics. Only way to improve our practical knowledge and move the field forward is to devote our efforts and resources toward better understanding of the biology and mechanism, which will ultimately lead to the practical translation of our basic knowledge from the laboratory to the treatment of patients in the clinics. In the long run, stem cell therapies may cut California's skyrocketing healthcare expenditures by reducing the need for expensive, long-term supportive care, which will be unavoidably pressing issues to the citizens of California in the very near future.